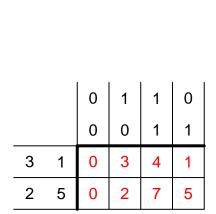
## s19 Matrix Exam (SLTN v517)

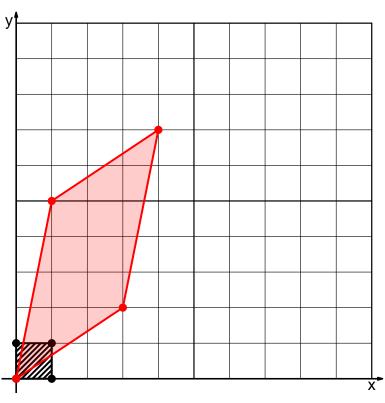
Let the  $2 \times 4$  matrix U represent four points in the xy-plane (so each column represents a point). When those four points are connected as a convex polygon, matrix U represents a unit square. Also, let the  $2 \times 2$  matrix L represent a linear transformation.

$$U = \begin{bmatrix} 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 \end{bmatrix} \qquad L = \begin{bmatrix} 3 & 1 \\ 2 & 5 \end{bmatrix}$$

Let matrix  $P = L \cdot U$ , so P is found by matrix multiplication of L times U. Matrix P also represents 4 points of a polygon. Use the diagram below to calculate the elements of P. Then, draw the polygon represented by matrix P on the xy-plane below. Notice I have already drawn the unit square represented by matrix U.

1. Multiply  $L \cdot U$  and draw resulting polygon.





2. What is the area of the convex polygon represented by matrix P? Hint: the area equals the absolute value of the determinant of matrix L.

$$\mathrm{area} \ = \ \det(L) \ = \ (3\cdot 5) - (1\cdot 2)$$

$$area = 13$$

The triangle shown below is composed of the three points represented by matrix  $A = \begin{bmatrix} 0 & 10 & 0 \\ 10 & 0 & 5 \end{bmatrix}$ . In order to reflect over the y axis and then rotate by 143.13° counterclockwise we can multiply by the transformation matrix  $R = \begin{bmatrix} 0.8 & -0.6 \\ -0.6 & -0.8 \end{bmatrix}$ .

3. Calculate the matrix  $R \cdot A$ .

$$R \cdot A = \begin{bmatrix} -6 & 8 & -3 \\ -8 & -6 & -4 \end{bmatrix}$$

4. Draw the triangle represented by  $R \cdot A$ .

